Overcoming Difficulties in Triangulating Soliton-Based Covert Transmissions

5 October 2023
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Introduction

Soliton-based communications have multiple applications including increasing the bandwidth of satellite communications, submarine communications, stealth integument-penetrating communications, and covert communications.

Soliton waves, given their properties, are resistant to conventional triangulation methods; a fact which is likely forcing various counterintelligence entities to employ creative methods to triangulate these increasingly commonplace covert signals.

Abstract

In order to understand why it is that soliton-based communications signals are difficult to triangulate, one needs to understand the pattern of propagation of the aforementioned waves. When a soliton wave travels over a distance, it diffuses as a somewhat collimated wall of energy but, unlike collimated light beams, for instance, the left and right-hand fringes of the walls of energy constituting a soliton wave remain parallel with one another as opposed to conventional EM, which would have a curved wavefront moving outward in all directions. This curved wavefront is what makes conventional triangulation possible.

While cellular transceivers are ubiquitous and support a robust signals intercept and triangulation program, soliton-based communications, given that they are based upon pulse modulation rather than frequency or amplitude modulation and given that these pulses are detected only as momentary increases in the amplitude of all ambient electromagnetism, such transmissions are entirely overlooked by these intercept platforms and even when a specific signal anomaly is bona fide as clandestine in nature, triangulation is nearly impossible using positionally fixed ground stations.

It would be possible to obtain an absolute positional fix on an unauthorized soliton signal along a single axis (on any one intercept pass) through the used of pairs of airborne SIGINT platforms.

A pair of aircraft may, whilst collecting signals, fly toward one another and use their sensitive ELINT equipment in order to look for a telltale sign of the presence of soliton waves: An apparent momentary increase in the apparent amplitude of all ambient signals in the environment. Each plane would be capable of detecting these subtle spikes in amplitude brought about by the soliton waves, but importantly, the ability to employ a form of interferometric analysis on the collected data enables a counterintelligence entity to discern the

point of origin of soliton waves by carefully measuring the difference between the interval of spikes detected by the plane moving in, for instance, the westward direction and the plane moving eastwardly.

The detection and analysis of something akin to a Doppler effect vis a vis soliton waves requires the ability to measure differences in timing on the order of the combined velocity of the ELINT aircraft (approximately 600 MPH) divided by the speed of light. This capability already exists in a robustly developed form and, when combined with real-time visual surveillance of a target area, would suggest that soliton waves may, in fact, be reliably triangulated only in the case that the time of a transmission is known to a counterintelligence entity in advance.

Therefore, like any system of covert communication, its level of effectiveness is largely dependent upon the level of competence with which it is employed.

Conclusion

Understanding the technical limitations of soliton triangulation approaches may suggest updated guidelines for proper utilization, for instance, the transmission of spoof signals in the opposite direction of the direction of intended broadcast. There are likely many precautions that may be used with a high degree of effectiveness against such cumbersome approaches to soliton triangulation as the one described.